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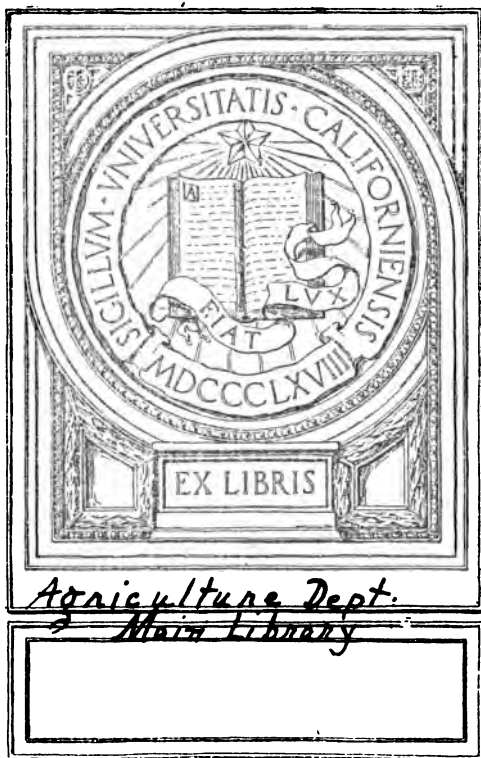
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LABORATORY MANUAL
IN
FIELD CROPS
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LABORATORY MANUAL IN FIELD CROPS



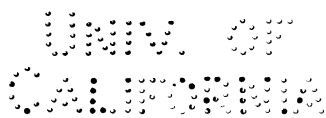
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WHEAT AND VETCH ON THE PACIFIC COAST

LABORATORY MANUAL IN FIELD CROPS

BY

CHESTER C. FARR, B.S.

"
COUNTY AGRICULTURAL AGENT, STATE COLLEGE OF
WASHINGTON, EVERETT, WASHINGTON



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PREFACE

FROM the introduction of Agriculture into the curriculum of our schools there has grown a demand that the student be brought into direct contact with the materials he deals with in his courses ; and in the study of field crops there is a need for a suitable outline to follow on each separate division of the work.

The author of this manual of Field Crops worked out in his own class room and with the advice and help of noted agriculturists, a series of practicums intended to acquaint the student with some of the most important phases of our common field crops.

The course is not intended to equip the student for scientific research work but for what we choose to call the work of practitioner agriculturist, and a very large number of those who study agriculture for four years, become members of this group. For this reason the student of field crops should be given a thorough knowledge of the fundamentals of plant growth and plant structure, which will give him a basis for interpreting any problem presenting itself in his handling of field crops.

In preparing this manual the author is indebted to the following books : Hunt's *Cereals in America* ; Bailey's *Cyclopedia of American Agriculture* ; Wilson and Warburton's *Field Crops* ; Shamel's *Corn Judging Manual* ; Coburn's *Book on Alfalfa* ; Hunt's *Forage and Fibre Crops* ; Livingston's *Field Crop Production* ; Spillman's *Farm Grasses of the United States* ; Lyon and Montgomery's *Examining and Grading of Grain*.

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INTRODUCTION

WHERE it is possible, we believe it is desirable to have the student gather the materials used in the laboratory. In some cases it is even more desirable to have the greater part of the laboratory in the fields near or on the agrostology plots.

There is no reason why each high school that carries a course in field crops, should not have a few agrostology plots where materials that are difficult to obtain can be grown, thus affording fresh material for the work. Suggestions and plans for this may be obtained from your state experiment station.

Each student should provide himself with a large loose-leaf notebook, one dozen sheets of cross section paper, one-half dozen sheets of medium grade drawing paper, and a note paper filler.

All exercises should be followed in sequence of relationship, and each written up in full as soon as completed. A plan which proves satisfactory to both teacher and student is to require the description of each experiment, as completed, to be handed in for approval or correction. It should be returned at the opening of the next laboratory period.

A list of selected references bearing on the subject is given at the close of each practicum. From a thorough study of these the student will get reliable information on each topic and it will serve to open up the vista for that subject.

It is assumed that the student has some knowledge of botany, and this course should illustrate and clarify biological principles learned in his previous study.

The following is a list of apparatus needed to equip the laboratory :

- 6 hand-lenses
- 12 1-pint fruit jars (Mason, with screw tops)
- 1 torsion balance
- 1 drying oven
- 12 evaporating dishes
- 6 rulers
- 2 tape measures
- 12 500-c.c. beakers
- 12 porcelain pie pans
- 1 large sheet of blotting paper
- 2 boxes of gummed labels
- 1 large tin can for seed samples
- $\frac{1}{4}$ yard No. 19 bolting cloth

The above apparatus may be obtained from the following companies :

Central Scientific Co., Chicago, Illinois.

University of Nebraska, Department of Instructional Agronomy, Lincoln, Nebraska.

W. M. Welch, Scientific Company, 1516 Orleans St., Chicago, Illinois.

We are indebted to the Department of Agricultural Journalism of the Iowa Agricultural College and to the United States Department of Agriculture for the cuts shown in the manual.

LABORATORY MANUAL IN FIELD CROPS

LABORATORY MANUAL IN FIELD CROPS

PRACTICUM NO. 1

Object. *To Study the Seedling Characteristics of Some of the More Common Plants.*

Materials. Sand, box 12" by 12" by 3", germination dishes, blotting paper.

Plant several seeds each of wheat, corn, peas, beans, in moist sand in the box and set in a warm place; keep the sand moist and watch the development as soon as the first sprouts appear above the ground.

Notice which bring part of the seed above the ground with them.

Method. Without injury to the young plant, clip off the greater part of the two halves of some of the beans and compare the development of plants thus treated with those which are allowed to grow normally.

Place a dozen kernels of wheat between wet blotters which have been cut to fit the inside of a pie plate; invert another pie plate over the first and set this germinator in a warm place for a few days, taking care that the paper remains moist.

Place several seeds in a similar germinator, which has been made in a large-necked bottle. Cork the bottle and immerse

completely in water; set in a warm place, being sure that there is enough water in the bottle to thoroughly moisten all the seeds. Determine, in comparison with the sand planting, what the effect of air is on the germination of seeds.

In a blotter germinator similar to the above, place some seeds of wheat and set the germinator in a warm place without the addition of water to the blotters.

STUDIES

1. Make drawings to show the difference in the characters and types of the various seedlings.
2. What do you conclude in regard to the food supply necessary for germinating seeds, as proved by the clipping of the cotyledons of some of the beans?
3. What factors are essential to germination?
4. What essentials in plant growth are not essentials in the germination of the seed?

REFERENCES

Farmers' Bulletin No. 408.

Bailey's *Cyclopedia of American Agriculture*, Vol. 2, pp. 5-21.

PRACTICUM NO. 2

Object. *To Study the Effect of the Depth of Planting on the Germination of Seeds.*

Materials. Corn, wheat, alfalfa seeds, a box 12" deep with one side replaced by glass, sand.

Method. Plant the seeds in the sand close to the glass in successive depths of 6", 4", 3", 2", 1", $\frac{1}{4}$ ". Set in a warm place and keep wet.

STUDIES

1. Which sprouts appear above the surface first?
2. Which are in the best condition when they appear, as shown by the color of their leaves, straightness, etc.?
3. What has caused the difference in those which have been planted deeper?
4. What influence has the depth of planting upon the root development?

REFERENCES

- Wilson and Warburton's *Field Crops*, p. 25.
Hunt's *Cereals in America*.
Livingston's *Field Crop Production*, pp. 30-31.

PRACTICUM NO. 3

Object. *To Show the Wide Variation in Plants.*

Materials. Cross section paper, ruler, several hundred ears or stalks of corn, or kernels or heads of wheat. As many examples as are deemed advisable may be used.

Method. Accurate measurements are to be made and tabulated in the field. Standardize the graph paper, lengthwise for the number of the ears, and crosswise for the inches. In the case of the ears of corn, graph so as to show the variation in the length and in the diameter at the middle of the ears.

STUDIES

1. How many ears are there of the same diameter?
2. How many of the same length?
3. What are the ways in which plants may be improved?
4. Explain how the breeders of plants have an advantage, and how they are at a disadvantage, in comparison with animal breeders.
5. Explain the importance of environment in relation to variation in plants.
6. What is Mendel's law?
7. Name some of the corn types.
8. How may one avoid wide variation in plants?

REFERENCES

- Bailey's *Cyclopedia of American Agriculture*, Vol. 2, pp. 3-21, 53.
Livingston's *Field Crop Production*, pp. 1-8.
Atkinson's *Botany*, p. 497.

PRACTICUM NO. 4

Object. *The Study of the Corn Kernel.*

Materials. Samples of corn, beakers, alcohol lamp, scales.

Method. Soak ten grams of corn in warm water until the outer coating can be easily torn off. Separate the following parts: testa, starch, embryo, endosperm. Dry these parts in the oven at a slow temperature for several hours, and then determine the percent of kernel made up by each part. (Check your residue on the original sample.)

(1) From seeds which have been soaked until they may be easily cut in pieces, make a drawing of a lateral cross section and label all parts.

(2) Make a drawing of a side section and label all parts.

STUDIES

1. Name ten products obtained from the kernel of corn. Tell from what part each is obtained.

2. From what part of the kernel are the most nutritious foods obtained?

3. What is the aleurone layer on the kernel, and where is it found in reference to the other layers?

REFERENCES

Hunt's *Cereals in America*.

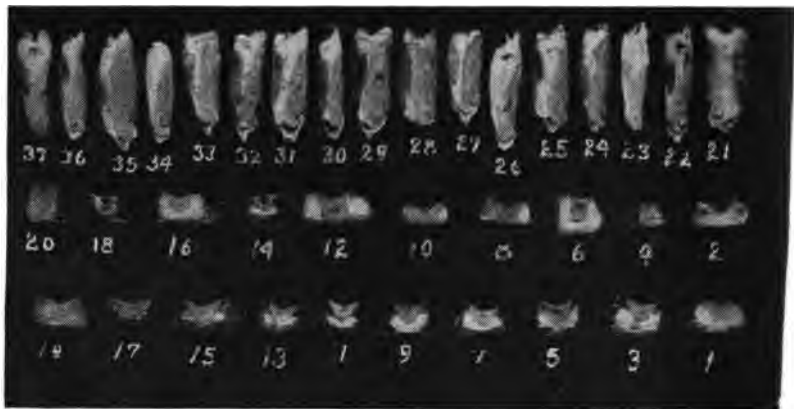
Bailey's *Cyclopedia of American Agriculture*, Vol. 2, p. 325.

Wilson and Warburton's *Field Crops*.

American Corn Products Company's *Corn Products*.

Farmers' Bulletin No. 298.

Livingston's *Field Crop Production*, pp. 51-53.



SOME COMMON TYPES OF KERNELS

(Showing lateral, germ end, and endosperm end cross sections.)

PRACTICUM NO. 5

Object. *How to Select Corn Seed.*

Materials. Score card on corn, eight ears of corn for each member of the class. (Score card may be obtained from the state experiment station.)

Method. Score eight ears by the use of the score card, after making sure that you understand all the terms used. (See Shamel's *Corn Judging* and Shoesmith's *The Study of Corn*.)

Make a germination test of each ear; after ten days make a reading of the test to determine which are dead and which are active.

STUDIES

1. Judging from these tests and scores, which ears would be the best to plant?
2. From the poorest ear, what would be the cost of the live

seed per pound, if the corn sold for 3 cents per pound on the ear?

3. Outline the methods best suited for the care of seed corn in your section. (See *Farmers' Bulletin* No. 323.)
4. Explain the following terms in the score card: uniformity, market condition, proportion of corn to cob, uniform kernel.
5. Give the necessary rules for scoring.
6. What constitutes a bushel of corn?
7. Of what importance is shrinkage?

REFERENCES

- Farmers' Bulletins* Nos. 249, 409.
Shamel's Corn Judging.
Farmers' Bulletins Nos. 199, 81, 229, 253.
Farmers' Bulletin No. 415, Corn Seed.
Livingston's Field Crop Production, p. 81.

SCORE CARD FOR JUDGING CORN

Type and uniformity	10
Maturity and market condition	10
Purity of kernel	5
Purity of cob	5
Shape of ear	10
Length of ear	10
Circumference of ear	5
Shape of kernel	5
Uniformity of kernel	5
Character of germ	10
Butts	5
Tips	5
Space between rows	5
Size of cob	10
Total	100

Student's name,

Date, Standing,

(The variety standard for length and circumference of the ear should be obtained by writing to your state experiment station.)

PRACTICUM NO. 6

Object. *To Calculate the Cost of Producing Corn.*

Method. This laboratory exercise is intended to acquaint the student with the factors to be taken into consideration in calculating the cost of producing a crop, and to get estimates on the cost of production for the locality. (This exercise may be worked out for the most important crop of the community.)

Include: Interest on the investment at 5%.

Cost of seed at 3 cents per pound.

Water right and maintenance charges in the case of irrigation.

Taxes.

Labor of preparing the soil.

Cost of implements, counting depreciation at 10% per annum.

Value of horses, depreciation 10% per annum.

When manures are applied, charge only that part used in the production of the crop, viz.: if six tons are applied every other year, only half of the cost of the fertilizer should be borne by one year's crop.

STUDIES

1. What profit would be realized from the average state yield at one cent per pound for the corn?

2. Where in the cost account could the farmer most readily reduce the expense of production?

3. If the expenditure of one ton of manure per acre at \$1.50 per ton, labor included, produced an increase of one-third in the crop, what would be the result on the profits?

REFERENCES

United States Department of Agriculture, *Yearbook 1913*, Average yields per acre.

Livingston's *Field Crop Production*, pp. 61-71, 54.

Farmers' Bulletins Nos. 303, 313, 414.

Hunt's *Cereals in America*, pp. 398-427.

PRACTICUM NO. 7 .

Object. *To Test the Result of Grading Corn Seed.*

Materials. Corn on the cob, access to a corn planter at a near-by hardware store or on a farm.

Method. Shell one ear with all the kernels.

Shell another ear and grade the seeds to uniform size.

Run both samples through the machine by propping the machine off the floor and turning the wheels.

Calculate the number of hills in one hundred (or the percentage of hills dropped) which contain either more or less than the regulation number of kernels.

STUDIES

1. What effect would this grading have on your stand of corn?

2. How many more pounds of seed would be required to plant an acre with the ungraded seed?

3. What would the grading per bushel be worth, *i.e.* how much more could you afford to pay for graded seed, if you consider only the amount of land one bushel will sow?

PRACTICUM NO. 8

Object. *Comparative Judging of Ear Corn.*

Materials. A large number of ears of corn, at least eight for every two members of the class.

Method. This work should be done individually and without reference to the manual. Place the ears in the order of their merit, and write your criticisms of each of the first three, telling why you placed the ears in that order. (As much of this work may be done as is deemed advisable; at least two or three laboratory periods are recommended.)

REFERENCES

Shamel's *Corn Manual*.

Livingston's *Field Crop Production*, p. 92.

Shoesmith's *The Study of Corn*.

PRACTICUM NO. 9

Object. *A Study of Some of the Common Diseases and Pests of Corn.*

Materials. Mounted specimens of the common insects: earworm, root louse, chinch bug, click beetle or wire worm. Mounted or dried specimens of the corn smut and ear mold.

Method. A great deal of time should be spent in reference work and in becoming familiar with the life history of the insects and the fungi.

STUDIES

1. From the references at hand, write an article of at least 500 words on one of the common corn pests or diseases in your State.
2. How do the grasshoppers survive the winter?
3. What are the most important features in the life history of the corn earworm?

REFERENCES

- Bailey's *Cyclopedia of American Agriculture*, Vol. 2, p. 35.
Farmers' Bulletin No. 248.
Weed's *Life History of Insects*.
Livingston's *Field Crop Production*, p. 93.

PRACTICUM NO. 10

Object. *A Study of the Wheat Head.*

Material. Preserved wheat heads, several for each student.

Method. Examine the heads of wheat. Remove the following parts, make drawings, and define empty glume, flowering glume, palea, rachis, spikelet.

For the head of wheat make the following determinations:

1. Number of spikelets in each spike.
2. Number of flowers in each spikelet.
3. Number of empty glumes in each spikelet.
4. How does the flowering glume differ from the palea?

Make a sketch of an empty glume to show beak, shoulder, auricle.

REFERENCES

- Bailey's *Cyclopedia of American Agriculture*, Vol. 2, pp. 373, 660-670.
Hunt's *Cereals in America*, pp. 26-137.
Livingston's *Field Crop Production*, p. 104.
Farmers' Bulletins Nos. 210, 466.

PRACTICUM NO. 11

Object. *A Study of the Wheat Plant.*

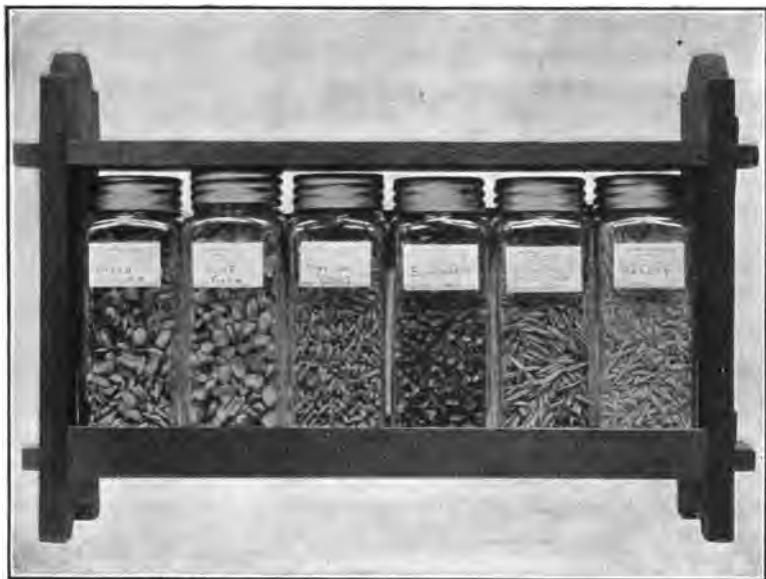
Materials. Wheat plants in the field or dried plants in the laboratory.

Method. Make the determinations and measurements from the material, and record in tabular form in your notebooks.

1. Length of spike, average of five spikes.
2. Shape, side view: square, flattened with the spike.
3. Shape, end view: square, flattened with the spike.
4. Number of sterile spikelets and where found?
5. Awns: length.
6. Awns: slender, medium, stout.
7. Awns: parallel, spreading.
8. Awns: deciduous, persistent.
9. Awns: light yellow, dark.
10. Spikelet: compact, spreading, widely spreading.
11. Spikelet: number of grains in average of five.
12. Basal hairs: long, short, medium, wanting, color.
13. Outer glume: color.
14. Outer glume: smooth, hairy, spinose.
15. Outer glume: wide, narrow.
16. Length of outer glume: medium, long.
17. Attachment of outer glume: firm, weak.
18. Beak: long, medium, short.
19. Shoulder: broad, medium, narrow.

REFERENCE

Hunt's Cereals in America.



PREPARED SAMPLES FOR CLASS USE

PRACTICUM NO. 12

Object. *A Study of the Wheat Kernel.*

Material. Samples of grain from several varieties.

Method. Examine the samples, and tabulate the determinations for each variety in your notebooks.

1. Density: hard, very hard, horny, dull, starchy.
2. Appearance of cross section: horny, dull, starchy.
3. Weight of seed, average of one hundred seeds.
4. Ratio of length to width. Divide length of 25 grains by the width of 25 grains, crease downward. (Use cross section paper.)
5. Shape: straight, curved, pear-shaped.

6. Plumpness : plump, medium, shriveled.
7. Cheeks : flat, plump, angular.
8. Tip : pointed, blunt. .
9. Base : pointed, blunt.
10. Crease : deep, medium, shallow ; wide, narrow.
11. Brush : large, small, short, long.
12. Color of grain : yellow, light yellow, clear amber, dull amber, clear red, dull red.

METHOD OF TABULATION IN THE NOTEBOOKS

NO. OF QUES.	VARIETY NAME	VARIETY NAME	VARIETY NAME	REMARKS

REFERENCES

Farmers' Bulletin No. 210.

Dolinger's *Book on Wheat*.

Livingston's *Field Crop Production*, pp. 107-137.

PRACTICUM NO. 13

Object. *The Study of Young Wheat Plants in the Field.*

Material. To be worked in the field on half matured plants. It is advised that as many varieties as possible, common to the community, be used for this study, in order that the student may become familiar with the variety characteristics of the young plants.

Method. Tabulate the description of the different varieties.

1. Color: light green, dark green, yellowish green, light gray green, medium gray, dark gray green.
2. Length of leaf blade, average of 10 blades.
3. Width of blades, average of 10 blades at the widest place.
4. Leaf blade: erect, ascending, drooping.
5. Leaf blade: smooth, rough, downy.
6. Leaf blade: veins prominent, veins not prominent.
7. Leaf blade: end tapering, end parallel with the sides.
8. Leaf sheath: green, green shading, purple.
9. Ligule: white, purple.
10. Ligule: $2\frac{1}{2}$ mm. long, 2 mm. long, 3 mm. long.
11. Auricles: white, green, purple tips, purple.
12. Auricles: hairy, partly hairy, smooth.
13. How many culms in each crown? (average of ten).
14. How many crowns in each square yard?
15. Do you consider this a good or poor stand?

PRACTICUM NO. 14

Object. *Judging of Wheat by Score Card.*

Materials. Several samples of wheat of market grading.

Method. Score each sample according to the score card.

STUDIES

1. What are the requirements for each of the following market grades of wheat: No. 1, No. 2, No. 3?
2. What are the market requirements in regard to smut?
3. What is meant by dockage in selling wheat?
4. What are the differences in quality of the hard and soft wheats?

REFERENCES

Standard grades of grain by State Commission of Grain and Hay Inspection.

Dolinger's *Book on Wheat*.

Hunt's *Cereals in America*, pp. 38-41.

Grades of Grain; National Grain Dealers Association, — 5¢ per copy,

J. F. Coucier, Secretary, Toledo, Ohio.

Livingston's *Field Crop Production*, p. 386.

PRACTICUM NO. 15

Object. *Comparative Judging of Wheat.*

Materials. One pint samples of wheat, small-sized grain tester.

Method. The weights per bushel may be ascertained before the work is started by the use of the grain tester and written on all samples.

This work should be individual and should be completed in a limited amount of time, depending upon the number of samples to be judged.

The samples are to be placed in the order of their merit, as on a milling basis, and reasons given for the first three placings.

No score cards are to be used. The work is to be handed to the instructor at the end of the allotted time.

REFERENCE

Livingston's *Field Crop Production*, p. 141.

PRACTICUM NO. 16

Object. *The Study of Flour and Flour Manufacture.*

Materials. Samples of whole wheat flour, bleached flour, graham flour, and corn meal, microscope, No. 19 bolting cloth.

Method. A very valuable addition to this exercise is a trip to a near-by flour mill, if convenient. A written report of the methods as observed by the student should be required.

Examine all of the samples supplied and determine the following, tabulating the results in the notebooks:

1. Granulations, under high-power microscope: round, angular, square.
2. Amount in a ten gram sample which will pass through a No. 19 bolting cloth.
3. Color, on plate glass under the dissect.
4. Percentage of gluten in a ten gram sample. Determine by the wash method as follows:

Weigh out a ten gram sample and place in an evaporating dish; mix into a stiff dough and keep adding more water, slowly working the mass until you have washed out all of the starch, which is proved by the failure to get a blue-colored reaction, when a weak solution of iodine is added to the wash water. (Be careful that none of the sticky gluten is washed away.) When the starch has been washed out, squeeze all the water possible from the mass of gluten and weigh. Place in the oven and when dry, weigh and determine the percentage of dry gluten in the flour of the original sample.

STUDIES

1. What parts of the kernel make up the whole wheat flour?
2. What relation does gluten have to bread making?

3. Describe the process of flour making in the different phases and the machinery used for each phase.

REFERENCES

Encyclopædia Britannica, Flour Manufacture.

Hunt's *Cereals in America*, pp. 113-121.

Charts on milling from Washburn Crosby Co., St. Paul, Minn.

Livingston's *Field Crop Production*, p. 115.

PRACTICUM NO. 17

Object. *The Study of the Oat Kernel.*

Materials. Samples of several varieties of oats; sample of clipped oats.

Method. Make the following comparisons in your notebooks.

STUDIES

1. In what ways does the oat grain differ from that of the wheat?
2. In what ways does the oat kernel differ from that of the wheat?
3. What botanical parts of the oat are persistent with the kernel?
4. Make a test of the samples given in order to determine the percentage of kernel to hull.
5. Which sample would be the best for food?
6. What would be the difference in price if the clipped oats sold for 60 ¢ per bushel, that is, how much could you afford to pay for clipping the oats?

REFERENCE

Livingston's *Field Crop Production*, pp. 145-150.

PRACTICUM NO. 18

Object. *A General Study of the Oat.*

Materials. Reference material.

Method. Research the reference material thoroughly and prepare a paper including study determinations.

STUDIES

1. What are the botanical differences between the oat and the wheat plants?
2. To what genus does each belong?
3. What is the composition of the oat? Compare its composition with the wheat and the barley.
4. Discuss the importance of the oat crop in comparison with the other cereal crops. (Given in the Year Book for 1913.)
5. To what uses are oats put, in comparison with wheat and corn?
6. Give the economic importance of the oat smut in the United States, and give methods best adapted to its control.

REFERENCES

- Farmers' Bulletins* Nos. 250, 436, 507.
Bailey's Cyclopedic of American Agriculture, Vol. 2, p. 485.
Hunt's Cereals in America, pp. 280-317.
United States Department of Agriculture, *Year Book* 1913.
Gray's Field Botany.
Livingston's Field Crop Production, pp. 145-150.

PRACTICUM NO. 19



SMUT ON OATS

Object. *A Comparative Study of the Methods of Treating Cereals for Bunt, Loose, or Covered Smut.*

Materials. Seeds of oats or wheat; copper sulphate (blue vitriol); formalin (40% solution of formaldehyde).

Method. Immerse several hundred seeds for ten minutes in a solution of copper sulphate made in the proportion of one pound to five gallons of water.

Allow the seeds to drain in a cloth or basket.

Test duplicate samples of treated and untreated seeds in a germinator and tabulate the results as shown in the form on the opposite page.

In a similar manner make a germination test of a sample of the same seeds, which have been immersed for ten minutes in water at 133° F. and quickly cooled by plunging into cold water.

Also make a germination test of seeds which have been sprinkled with formalin, and kept in a closed box for 30 minutes, or tightly covered with a cloth for 1 hour.

PERCENTAGE OF GERMINATION	No. 1	No. 2	AVERAGE
Untreated seed			
Copper sulphate treated			
Hot water treated			
Formalin treated			

STUDIES

1. What do you conclude as to the effect of these treatments on the viability of the seeds?

PRACTICUM NO. 20

Object. *A Study of the Oat Plant.*

Materials. Dried specimens of oat panicles.

Method. Examine dry panicles which are at hand and answer the following in tabular form in your notebooks.

1. Length of panicle, average of five panicles.
2. Number of whorls, average of five panicles.
3. Number of main branches, average of five panicles.
4. Number of spikelets, average of five panicles.
5. Variation in the length of the pedicle. to
..... inches.
6. Number of grains, average of five panicles. (Reserve until the last.)
7. Number of grains per spikelet.
8. Weight of grains, average of five panicles of 100 grains each.
9. Relative size of lower and upper grains.
Weight of 25 upper grains,
Weight of 25 lower grains,
10. Percentage of kernel,; weight of 100 grains,
.....; weight of 100 kernels,; percentage
of kernel to grain,
11. Plumpness of kernel: plump, medium, inflated.
12. Flowering glume: thick, medium, thin.
13. Length of 25 grains from base to tip of flowering glume;
from the base to the tip of the kernel,
14. Density, determined by the grain tester, or by weighing
an exact number of cubic inches, and reducing to weight per
bushel.
15. Color of the grain: light yellow, gray, reddish brown,
black.

16. Diameter of the rachis, average of five.
17. Depth of furrow below the branches : furrowed, medium, smooth.
18. Wall of culm : thick, medium, thin.
19. Panicle : open, partly open, closed.
20. Flowering glume : beardless, partly bearded, bearded.

REFERENCES

Livingston's *Field Crop Production*, pp. 144-150.

Lyon and Montgomery's *Examining and Grading Grain*, pp. 51-55.

PRACTICUM NO. 21

Object. *A Study of the Market Grades of Oats.*

Materials. Four-ounce samples of market oats; score card.

Method. From the state standard grades of oats as established by the state commission of grades and grains, and by use of the score card make scorings of at least four of the different samples.

STUDIES

1. What are the requirements for the following grades? Numbers 1, 2, 3, 4 and feed?

2. What precautions in harvesting will prevent off-color in oats?

SCALE OF POINTS	PERFECT	NUMBER OF SAMPLE
1. Uniformity of grains . .	10	
2. Color	10	
3. Size and plumpness . .	15	
4. Percent hull	15	
5. Percent foreign matter .	15	
6. Percent damaged grain .	15	
7. Weight per bushel . .	20	
Total	100	

REFERENCE

Livingston's *Field Crop Production*, p. 148.

PRACTICUM NO. 22

Object. *To Practice Comparative Judging of Oats on the Standard Grades.*

Materials. One quart of samples of market oats.

Method. Follow the same method as outlined for the comparative judging of wheat in Practicum No. 15, p. 19. Individual work is very important in this practicum.

Weigh out a ten gram sample, separate from the grain all the foreign matter, weed seeds, straw, dirt, etc., and then determine the percentage of pure seed by weight.

Determine by the germination test the percentage of viable seeds in forty-eight hours.

The percentage of viable multiplied by the percentage of pure seeds equals the percentage of pure viable seeds in the sample.

STUDIES

1. Of what value is the pure viable seed test?

REFERENCES

Livingston's *Field Crop Production*, pp. 374-377.

Lyon and Montgomery's *Examining and Grading Grain*, pp. 94-99.

PRACTICUM NO. 23

Object. *A Study of the Rye Plant.*

Materials. Matured plants in the field, or the entire matured plant dried in the laboratory.

Method. Make a study of the plant, and tabulate the following data in your notebooks:

1. Height of the culm, average of ten culms to the tip of the awn.
2. Culm: diameter below the spike, average of ten culms.
3. Wall of culm compared with the oat: thick, medium, thin.
4. Foliage compared with that of the wheat: scanty, medium, abundant.
5. Is there any rust present? If so, what percentage of the leaves are affected?
6. Is there any ergot present? If so, what percentage of the heads are affected?
7. Spike: erect, leaning, nodding.
8. Length of spike, average of ten spikes from the lower part of the rachis to the tip of the outer glume.
9. Number of grains per spikelet.
10. Number of grains per spike, average of ten spikes.
11. Weight of 100 grains.
12. Size: length of ten grains, width of ten grains.
13. Plumpness: plump, medium, shrunken.
14. What is the standard weight per bushel for rye?
15. Make a drawing of the outer glumes of wheat and rye for comparison.

REFERENCES

- Hunt's *Cereals in America*, pp. 345-355.
Bailey's *Cyclopedia of American Agriculture*, p. 375.
Livingston's *Field Crop Production*, pp. 177-181.

PRACTICUM NO. 24

Object. *A Study of the General Characteristics and Importance of the Common Sorghums.*

Materials. Dried plants, panicles, seeds of the most important sorghums.

Method. Make a study of the samples and write a report.

STUDIES

1. Name three general groups of sorghums according to the products obtained from them. Name three plants in each group.

2. Describe and compare the inflorescence of the sorghums with that of the wheat.

3. How does the composition of the kernel compare with that of corn? Would it be more or less valuable, pound for pound, as food?

4. Discuss briefly the following plants related to the sorghums: Sudan grass (*Year Book 1912*); Johnson grass; Kafir corn; Milo maize; Broom corn (*Bailey's Cyclopedia of American Agriculture*, Vol. 2, pp. 367-380).

5. Make a rough sketch of a sorghum panicle to show the principal parts.

REFERENCES

United States Department of Agriculture, *Year Book 1912*.

Bailey's Cyclopedia of American Agriculture, Vol. 2, pp. 367-380.

Farmers' Bulletins, No. 322, Milo Maize; No. 246, Saccharine Sorghums; No. 458, Sweet Sorghums for Forage; No. 448, Sorghums for Grain; No. 288, Non-saccharine Sorghums; No. 50, Sorghums as Forage; No. 174, Broom Corn.

Hunt's *Cereals in America*, pp. 384-399.

Bureau of Plant Industry Bulletin No. 175.

Livingston's *Field Crop Production*, pp. 225-235.

PRACTICUM NO. 25

Object. *A Study of the Characteristics of Some of the Common Forage Crop Seeds.*

Materials. Four-ounce samples of seed of the following: timothy, red clover, white clover, alfalfa, vetch, blue grass.

Method. Examine each under the dissect lens, and write up the description in tabular form, as outlined in the following questions:

STUDIES

1. Weight of seed, average of 100 seeds.
2. Length of seeds, average of 25 seeds.
3. Width of seeds, average of 25 seeds.
4. Shape of seeds (drawing): spherical, flat, heart-shaped.
5. Color.
6. Hardness: soft, medium, hard, brittle.
7. Covering: glume, pod. If a pod, what is the shape?
8. Where is the embryo located? Make a drawing to show.
9. What are some of the impurities? (*Farmers' Bulletin, Adulteration of Seeds, No. 382.*)
10. What is the scientific name for the plants studied?

REFERENCES

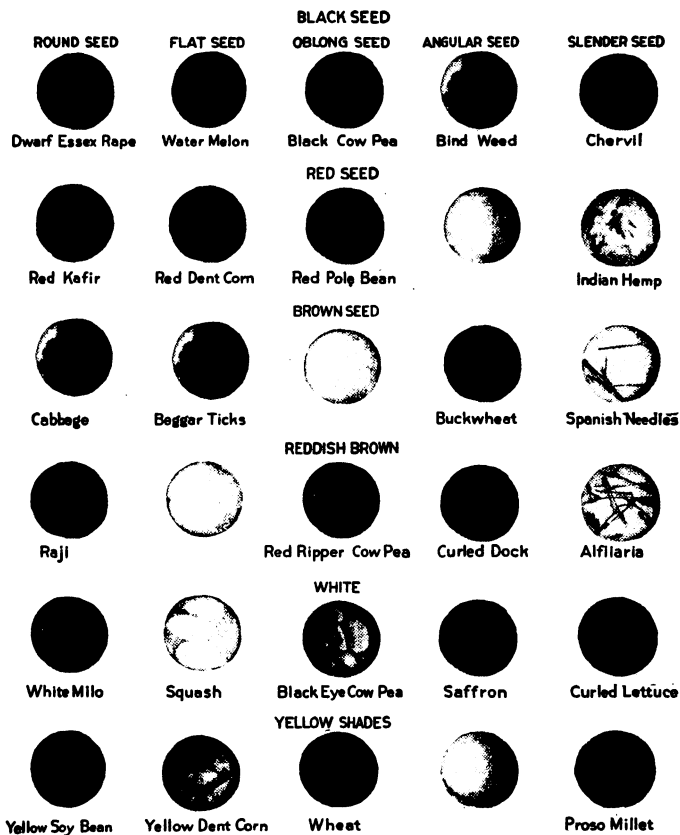
Bailey's *Cyclopedia of American Agriculture*, Vol. 2.

Hunt's *Cereals in America*.

Farmers' Bulletin No. 382.

Livingston's *Field Crop Production*, p. 374.

Lyon and Montgomery's *Examining and Grading Grains*, pp. 87-93 (very good).



SEED MOUNTS

PRACTICUM NO. 26

Object. *Identification of Legume Seeds and their Impurities.*

Materials. Impure samples of market legume seeds.

Method. From the sample supplied, which is a mixed sample of legume seeds and the common impurities found in the legumes on the market, separate the impure seeds from the sample and give the name and description of each.

REFERENCES

Farmers' Bulletin No. 428, Testing of Farm Seeds.

Hunt's *Forage and Fiber Crops*.

Livingston's *Field Crop Production*, p. 374.

Ohio Agricultural Experiment Station Bulletin, No. 175.

PRACTICUM NO. 27

Object. *Classifying Impurities in Grass Seeds.*

Materials. One or more market samples of any of the grass seeds mixed with some of the weed seeds which are commonly found in the meadows.

Method. Separate the foreign seeds from the sample, and identify by drawings or by description.

REFERENCES

Michigan Station Bulletin No. 260.

Iowa Station Bulletin, Vitality, Adulteration, and Impurities of Alfalfa and Timothy Seeds, No. 88.

Ohio Agricultural Experiment Station Bulletin No. 175.

Lyon and Montgomery's *Examining and Grading Grains*, pp. 87-93.

PRACTICUM NO. 28

Object. *A Study of Some of the More Common Weeds.*

Materials. Dried samples of weeds. It is better, when possible, to do the work in the field.

Method. Examine each of the following weeds and answer the questions as given below: chess or cheat grass, dandelion, sweet clover, sour dock, Australian salt bush, mustard, Johnson grass, crab grass. Others may be added when deemed advisable.

STUDIES

1. Is it an herb or a shrub?
2. Is it an annual, biennial, or perennial?
3. Root: fibrous, tap, rhizoidous, fleshy, stout.
4. How deeply do the roots penetrate?
5. Is it a drooping or an erect plant?
6. To what group of plants is it closely related?
7. Why has this plant become a weed?
8. Is it bitter, or tough? Would stock eat it?
9. In what particular is it different from its relatives?
10. Leaves: broad, drooping, narrow, erect, glabrous, hairy.
11. Do its seeds have arrangements for transportation?
12. Would you judge it to be easily killed by plowing?
13. Would you judge it to be easily killed by spraying?
14. Discuss and give methods for eradication.

REFERENCES

- Bailey's *Cyclopedia of American Agriculture*, Vol. 2.
Hunt's *Cereals in America*.
Ohio Bulletin No. 175.
Livingston's *Field Crop Production*, p. 219.

PRACTICUM NO. 29

Object. *A Study of the Characteristics of Some of the Common Legume Seeds.*

Materials. Four-ounce samples of the following legume seeds: alfalfa, red clover, white clover, alsike clover, vetch, Canada field peas, navy beans, crimson clover, cowpeas, lespedeza; dissect lens.

Method. Tabulate the examination in the notebook as follows:

STUDIES

1. Seed, viewed from the two largest diameters: round, oval, elliptical, kidney-shaped.
2. Seed, viewed from the two smallest diameters: round, oval, flat.
3. Seed, length of largest diameter,
4. Seed: orange, black, yellowish brown, yellow, reddish, red, green, yellowish green.
5. Hilum: round, oval, elongated.
6. Radicle: more than half of the edge, half of the edge, less than half of the edge.
7. Radicle: tip prominent, tip not prominent.
8. How many weed seeds in each pound of the varieties examined?
9. What characteristics serve to identify each species?

REFERENCES

Hunt's *Forage and Fiber Crops*, p. 150.

Lyon and Montgomery's *Examining and Grading Grains*, pp. 87-93.

PRACTICUM NO. 30

Object. *A Study of the Alfalfa Plant.*

Materials. A field study of the plants and reference work.

Method. Examine the plants in the field and write the description of them as suggested by the outline given here.

STUDIES

1. How does the alfalfa produce the second crop of hay?
2. Is there any indication of this new growth at present?
3. How do alfalfa leaves differ from clover leaves?
4. Make a drawing of the alfalfa leaf.
5. Count the leaves on ten stems of the alfalfa plant. On an average, how many leaves are there for each stem? On an average, how many stems to a plant?
6. How many plants to the square yard of ground?
7. What are the most dangerous weeds present in each of the fields examined?
8. Would you consider this a good stand of alfalfa?

REFERENCES

Livingston's *Field Crop Production*, pp. 278-291.
Ohio Bulletin No. 175.

PRACTICUM NO. 31

Object. *An Examination of Commercial Clover Seeds.*

Materials. Samples of commercial clover seed.

Method. Weigh out five grams of each sample of seeds, separate the sample into three parts, pure seeds, weed seed, and inert matter. Make a germination test of the clover seed by placing one hundred seeds in the germinator and leaving it for five days.

Tabulate the results in the notebook as suggested by this outline :

STUDIES

Total weight of seeds.

Weight of pure clover.

Number of weed seeds per pound.

Weight of weed seed, milligrams.

Weight of inert matter, milligrams.

Pure seed %.....

Weed seed %.....

Inert matter %.....

Germination %.....

Pure viable seeds %.....

Sample 1, costs¢ per pound.

Sample 2, costs¢ per pound.

What is the actual cost per bushel of pure viable seed in each sample?

If sown at the rate of nine pounds per acre, how many weed seeds per acre would be sown in each case?

PRACTICUM NO. 32

Object. *An Examination of Commercial Alfalfa Seed.*

Materials. Samples of commercial alfalfa seed.

Method. Follow the same method here as given for the examination of commercial clover seed in Practicum No. 31.

STUDIES

If sown at the rate of 18 pounds per acre, calculate the number of weed seeds sown to the acre.

Report on *Farmers' Bulletins* Nos. 339, 428.

1. Where in the United States is most of the alfalfa seed produced?
2. Are there any imports? If so, from where?
3. What are some of the common impurities?
4. What is the color of good seed?
5. What is used to adulterate alfalfa seed?

REFERENCES

Ohio Bulletin No. 175.

Livingston's *Field Crop Production*, p. 287.

PRACTICUM NO. 33

Object. *A Study of Permanent Pasture Grasses.*

Materials. Grass plats or fresh samples of the grasses.

Method. Arrange in tabular form the following information on the grasses given to consider :

1. Botanical name.
2. Foliage : large, abundant, fine, scarce.
3. Foliage : tall, low, erect, drooping.
4. Fibrous rooted : stoloniferous, rhizome.
5. Inflorescence : spike, panicle.
6. Tufted, tillering, sod forming.
7. Easily killed out, difficult to kill out.
8. Grasses to be studied : Kentucky blue grass, orchard grass, brome grass, tall, oat grass, meadow fescue, timothy, red top, English, rye grass, Bermuda grass, Italian rye grass.

STUDIES

1. What influence does the variety of plants have on the value of pasture lands?
2. What are the advantages and the disadvantages of planting grasses in mixtures? (Hunt's *Forage and Fiber Crops*, p. 21; Livingston's *Field Crop Production*, p. 371.)
3. How many plants to the acre are desired in pasture lands and how many seeds should be sown to secure this? (See Hunt's *Forage and Fiber Crops*, pp. 12-13; Bailey's *Cyclopedia of American Agriculture*, Vol. 2, p. 439; Livingston's *Field Crop Production*, p. 372.)
4. Name four factors to be considered in choosing varieties

for mixtures. (Bailey's *Cyclopedia of American Agriculture*, Vol. 2, pp. 437-438.)

5. Give three ways of improving worn-out or run-down pasture lands. (Bailey's *Cyclopedia of American Agriculture*, Vol. 2, p. 442; Hunt's *Forage and Fiber Crops*; Livingston's *Field Crop Production*, p. 378.)

PRACTICUM NO. 34

Object. *A Study of the Vegetative Portions of the Common Grasses.*

Materials. The grasses in the field or on the agrostology plots.

Method. Make observations and tabulate the descriptions in the notebook, according to the following plan :

1. Scientific name.
2. Common name.
3. Where found.
4. Leaf sheath : round, partly split, entire. Leaf sheath : length, from.....inches to.....inches.
5. Ligule : long, medium, short, acute pointed, obtuse pointed, truncate, rectangular, serrated edges, not serrated.
6. Leaf blade : erect, ascending drooping, smooth, downy, rough, rolled or convolute in the bud, folded or conduplicate in the bud.
7. Color leaf blade..... Length.....inches to.....inches.
8. Leaf blade : length.....inches to.....inches.
9. Midrib : prominent, medium, small.
10. End of blade : acuminate ; tapering, obtuse, parallel-sided.
11. Lower internode : normal, thickened.
12. Habit of growth : number of stolons, short stolons, long stolons.
13. What characters serve to identify this grass ?

REFERENCE

Livingston's *Field Crop Production*, pp. 5-11.

PRACTICUM NO. 35

Object. *A Study of Commercial Timothy Seed.*

Materials. Samples of commercial timothy seed.

Method. Weigh out two and one-half grams of timothy seed. Separate the pure timothy from the inert matter, and the impure seeds and weed seeds. Place 100 timothy-seeds in a germinator, and leave for about 14 days, examining them at intervals of 24 hours, until they commence to germinate. Tabulate the data in the notebooks for this, as you did for similar work on the legume seeds.

Weight of sample	Milligram
Weight of pure timothy	Milligram
Weight of inert matter	Milligram
Weight of weed seeds	Milligram
Pure timothy	Percent
Inert matter	Percent
Weed seeds	Percent
Germination of pure timothy	Percent
Pure viable seed of timothy	Percent

STUDIES

If this sample sold for \$9.00 for 45 pounds, what did the pure viable timothy seed cost per bushel?

PRACTICUM NO. 36

Object. *Examination of Some of the Common Legumes.*

Materials. Field work on growing plants, or material from the agrostology plots.

Method. Make an examination of the following legumes grown in your section, and report as outlined below. Tabulate the results in your notebook: White clover, Sweet clover, Red-clover, Alfalfa, Vetch, Peas.

(Other legumes may be substituted or added.)

1. Make a sketch of the leaf to show the shape, size, etc.
2. Root: tap, fibrous, rhizoidous.
3. Root: long, medium, shallow.
4. Annual, biennial, perennial.
5. Foliage: large, scarce, abundant.
6. Stems: large, small, coarse.
7. Stems: sweet, bitter, acrid.
8. Shape of nodules.
9. Nodules: numerous, scarce, large, small.
10. Where are the nodules formed, — tap, fibrous, feeding roots?

STUDIES

1. What causes these nodules on legumes?
2. Of what advantage are the nodules to the alfalfa?
3. The same bacteria will not infect all legumes; what would you advise for inoculation?
4. Name the legumes best adapted to the following sections of the United States and tell why: Southeastern, Central, Southern, New England, Atlantic, Pacific Coast.
5. Name and give the methods for three ways of inoculation.

6. Give a suitable rotation using red clover as the legume crop for your section of the state.

7. Actual problems on suggestive rotations for near-by farms may be carried out very satisfactorily by taking the class out to study the problem and allowing them to make suggestions.

REFERENCES

Farmers' Bulletin No. 339.

Farmers' Bulletin No. 445.

Illinois Bulletin No. 134.

Ohio Bulletin No. 142.

Livingston's *Field Crop Production*, pp. 23, 247-250.

PRACTICUM NO. 37

Object. *A Study of the Characteristics of Some of the Common Grass Seeds.*

Materials. Eight four-ounce samples of the grass seeds, hand lens.

Method. Examine the grass seeds and tabulate the information asked for below.

1. Flowering glume :

Length, average of five.

Blunt, pointed.

Straight, curved.

Awned, awnless.

Color : red, brown, silver.

Hyaline, chartaceous.

Keel : prominent, medium, absent.

Keel : smooth, hairy.

Adherence : strong, medium, weak.

2. Rachilla :

Long, short, variable.

Slender, broad.

Smooth, hairy.

Standing away, compressed to the palea.

Absent.

3. Give the most important character for identification of each variety studied.

REFERENCES

Hunt's *Forage and Fiber Crops*.

Bailey's *Cyclopedia of Agriculture*, Vol. 2.

Lyon and Montgomery's *Examining and Grading Grains*, pp. 87-93.

PRACTICUM NO. 38

Object. *A Study of Root Crops.*

Materials. Reference work.

Method. Write up the answers and descriptions in your notebook.

1. What plants are included under root crops? What are their principal uses? Name five principal states noted for root crop production.

2. Name the four types of beets, and tell for what each one is used.

3. Describe the culture of the beet as to the following: soil, amount of seed, method of seeding, cultivation, harvesting.

4. Describe the culture of carrots in the same way as for beets.

5. Give a botanical description of the rape plant and compare with the kale plant. Explain the uses of each of these. In what part of the United States are they mostly grown?

6. Explain the difference between a root and a tuber.

7. Give the principal botanical characters of the potato and the history of its cultivation.

8. What plants are closely related to the potato?

9. What country is the largest producer of the potato?

REFERENCES

Bureau of Plant Industry Bulletin No. 164.

Bailey's Cyclopædia of Agriculture, pp. 539-550.

Livingston's Field Crop Production, pp. 359-363.

PRACTICUM NO. 39

Object. *The Use of the Potato and the Qualities of Good Seed.*

Materials. Reference work.

Method. Answer all questions and give all discussions in full in your notebooks.

1. Name five plants belonging to the same family as the potato. (Gray's *Botany*.)

2. Discuss the following factors as influences on potato yields: purity of seed, productive parents, immaturity of seed, diseased condition, amount per hill, storage of seed, size of seed. (*Farmers' Bulletins* Nos. 35, 533.)

3. Discuss with reference to the causes, the nature of the damage, and eradication methods, the following diseases and pests: late blight, blackleg, Colorado beetle, dry rot, scab, rhizoctonia.

4. Discuss the importance of the potato as a source of denatured alcohol, and tell briefly how denatured alcohol is made.

REFERENCES

United States Department of Agriculture, *Office of Experiment Stations Circular* No. 77, p. 37.

Bailey's *Cyclopedia of American Agriculture*, Vol. 2, pp. 519-528.

Farmers' Bulletins Nos. 35, 533.

Farmers' Bulletin No. 91.

Farmers' Bulletin, Denatured Alcohol, No. 410.

PRACTICUM NO. 40

Object. *To Become Familiar with Desirable Qualities in Market Potatoes.*

Materials. Several ten-tuber samples for scoring and several different varieties for cooking.

Method. Score all of the ten-tuber exhibits and place the score according to the score card given. Cook one of each of the varieties to be tested for cooking qualities and test according to the score card given.

POTATO SCORE CARD

10 tubers

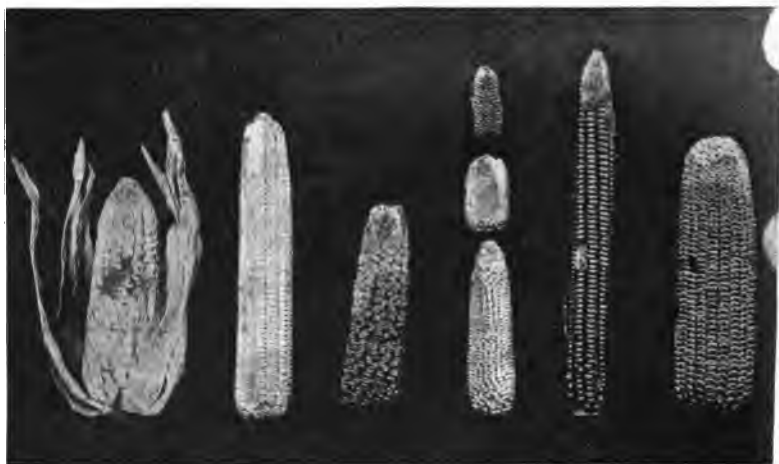
Uniformity of exhibit	20
Trueness to type	10
Size of tubers	15
Eyes: shallowness, etc.	5
Shape of tuber	10
Texture of the flesh	5
Skin: smooth, clean, clear	5
Color of flesh	5
Soundness of flesh	10
Freedom from surface blemishes	15
Total	100

COOKED POTATOES

External appearance	20
Quality and condition of flesh: soggy or mealy	20
Color of flesh: dark or light	15
Flavor	15
Time required for cooking	10
Uniformity of all tubers in cooking	20
Total	100

REFERENCE

Livingston's *Field Crop Production*, p. 336.



THE TYPES OF CORN

PRACTICUM NO. 41

Object. *A Study of Crop Rotation Plans.*

Materials. Reference work.

Method. Consult the references before making your report.
Discuss the following topics in full:

1. What is crop rotation?
2. Where did the scheme of crop rotations originate?
3. Name five advantages to be gained through the use of crop rotations.
4. Give and explain three crop rotations suitable for your district, and give details for working this out. (*Parker's Farm Management and Crop Rotations.*)

REFERENCES

- Bailey's *Cyclopedia of American Agriculture*, Vol. 2, p. 120.
Lowther's *Cyclopedia of Horticulture*.

Snyder's *Soils and Fertilizers*.

Wilson and Warburton's *Farm Crops*.

United States Department of Agriculture, *Year Book 1907*, pp. 385-398.
Bureau of Plant Industry Bulletin No. 142.

United States Department of Agriculture, *Year Book 1902*, pp. 519-532.

Livingston's *Field Crop Production*, pp. 14-25.

PRACTICUM NO. 42

Object. *A Study of the Flax.*

Materials. Dried culms of the flax, a sample of mature seed. If possible have an exhibit of the different processes through which the flax goes in the manufacture of linen.

Method. Examine the mature plants and describe by comparing with the other grain crops.

1. What parts are used for the manufacture of the linen?
2. Describe briefly the processes used in obtaining the fibers.
3. Examine samples of flax seed and score according to the following score card :

Weight per bushel	30
Uniformity	5
Color	10
Purity	5
Plumpness	15
Luster	5
Odor	5
Weed seed	10
Dirt	5
Injured kernels	2
Weathering	8
Total	100

Explanation of the points :

Weight per bushel (56 pounds), important; determine by grain tester.

Uniformity: seeds of same shape and size.

Color: distinct for each variety.

Purity: distinguished by size, shape, color, trueness to type.

Plumpness: well rounded out on both sides on close examination.

Luster: bright and shiny.

Odor: sweet, free from musty, bin, or off odors.

Weed seed: free from foreign seeds.

Dirt: foreign material should not be present.

Weathering: dull appearance, stick together, objectionable.

Cut one and one-half points for each pound less than the standard weight per bushel.

REFERENCES

Farmers' Bulletin No. 27, Flax for Fiber.

Farmers' Bulletin No. 274, Flax Culture.

Bailey's *Cyclopedia of American Agriculture*, Vol. 2, pp. 293-394.

Wilcox and Smith's *Cyclopedia of Agriculture*, pp. 50-52.

Livingston's *Field Crop Production*, pp. 354-355.

PRACTICUM NO. 43

Object. *A Study of Cotton.*

Materials. Comb, tape measure, matured cotton.

Method. Study according to the following outline. (Field work.)

Planting:

distance apart of the rowsft.....in.

distance apart of the plants.....ft.....in.,

average of ten.

Ground: level or ridged, weedy or clean, compact or mellow.

Plants: tall or short, wide, medium or narrow, tap-rooted or shallow-rooted, internodes long or short, average length..... inches.

From what point do the fruiting branches grow?

Leaves: lobed or entire, pedicelled or sessile, opposite or alternate, stipulate or not stipulate.

Bolls: average length of ten.....; circumference of ten.....; long or short; large or small; pointing upward or downward.

Carpels: heavy or thin, rolled or not rolled, blunt-pointed or sharp-pointed, average number.

Lint: White, amber, or brown, ripe or unripe, abundant, medium, or thin, clean or dirty, adherence strong, medium, or weak.

Length of lint:inches.

Comparative strength: weak, medium, strong.

Seed: large or small, fuzzy or smooth; if fuzzy, white or green; if smooth, black or brown.

Hilum: at the large or small end of seed, comb out the lint. Is the longest at the small end or at the large end of the seed?

REFERENCES

United States Department of Agriculture, *Office of Experiment Stations Bulletin No. 33.*

United States Department of Agriculture, *Year Book 1912.*

Farmers' Bulletins Nos. 216, 223, 290, 48, 47, 217.

C. P. Brooks' *Cotton, Its Uses and Varieties.*

PRACTICUM NO. 44

Object. *Judging Market Cotton.*

Materials. Matured dried bolls of cotton.

Method. Use the score card and judge several different samples of market cotton.

Size of bolls (15 points)	{ Very large, 15 points Large, 14 points Medium, 12 points Small, 8 points Very small, 3 points
Length of lint (20 points)	{ 2 inches, 20 points $1\frac{7}{8}$ inches, 19 points $1\frac{3}{4}$ inches, 18 points $1\frac{1}{2}$ inches, 17 points $1\frac{1}{4}$ inches, 15 points $1\frac{3}{8}$ inches, 10 points $1\frac{1}{4}$ inches, 5 points
Fineness of lint (10 points)	{ Very fine, 10 points Fine, 8 points Medium, 6 points Coarse, 3 points
Yield (20 points)	{ Excellent, 20 points Good, 18 points Medium, 15 points Light medium, 10 points Light, 5 points
Uniformity in length of lint (7 points)	{ Excellent, 7 points Good, 6 points Fair, 4 points Poor, 2 points
Strength of lint (10 points)	{ Very strong, 10 points Strong, 8 points Medium, 6 points Weak, 3 points

Percent of lint (18 points)	{ 33 percent, 18 points
	{ 31-32 percent, 17 points
	{ 29-30 percent, 16 points
	{ 27-28 percent, 15 points
	{ 25-26 percent, 10 points
	{ 23-24 percent, 5 points

REFERENCE

Livingston's *Field Crop Production*, pp. 336-354.



APPENDIX

In cases where the student is given credit for work done on the farm during the summer months, as is already the plan followed in a few states, the question presents itself as to what kind of work shall be recognized as worth while. If it is to be connected with the work in field crops some of the problems listed below may be given the student as practicums to be worked out.

1. To determine the effect of planting legumes on inoculated and non-inoculated soil.
2. To keep a cost account of one or more crops for one year.
3. The hybridization of plant types.
4. The gathering and preservation of material for use in the laboratory.

When this kind of work is pursued it is advisable that the teacher outline the work to be followed for the year, supervise it during the summer, and require a written report to be submitted at the end of the season.

WEIGHTS AND MEASUREMENTS WITH EQUIVALENTS

METRIC

The gram¹ is the unit of weight.

Milligram (mg.) = 0.001 gram.

Kilogram (Kg.) = 1000 grams.

The liter² is the unit of capacity.

1 cubic centimeter = 0.001 liter.

The meter is the unit of length.

Millimeter (mm.) = 0.001 meter.

Centimeter (cm.) = 0.01 meter.

FORMULÆ

A cubic foot of water weighs 62.42 (approximately $62\frac{1}{2}$) pounds.

Area of a cylinder = $2\pi rh$, where h is the height or length of the cylinder,
 $\pi = 3.1416$, r = radius.

Volume of a cylinder = $\pi r^2 h$.

The radius of a circle = $\frac{\text{circumference}}{2\pi}$.

Circumference of a circle = $2\pi R$.

To convert from C scale to F scale multiply by $\frac{9}{5}$ and add 32.

To convert from F scale to C scale subtract 32 and multiply by $\frac{5}{9}$.

¹ 1 gram = 0.035 of an ounce.

= 0.002 of a pound.

= 1 cubic centimeter at 4° C.

² 1 liter = 1.035 (or approximately 1) quart.

LEGAL WEIGHT PER BUSHEL OF SEEDS

STATE OR TERRITORY	BARLEY	BEANS	BLUE GRASS	CLOVER	CORN IN EAR	UNSHUCCED CORN IN EAR	CORN SHELLED	ITALIAN RYE	OATS	PEAS	REDTOP	RYE	TIMOTHY	WHEAT
Alabama . . .	40	60			70	75	56		32	60		56		60
Arizona . . .	40	60					54		32			56		60
Arkansas . . .	48	60	14	60	70	74	56		32	60	14	56	60	60
California . . .	50						52		32			54		60
Colorado . . .	48	60	14	60	70		56		32			56	45	60
Connecticut . . .	48	60		60			56		32	60		56	45	60
Delaware . . .							56							60
Florida . . .	48	60				70	56		32			56		60
Georgia . . .	47	60	14	60	70		56		32	60		56	45	60
Idaho . . .	48			60			56		36			56		60
Illinois . . .	48	60	14	60	70		56		32			56	45	60
Indiana . . .	48	60	14	60	70		56		32			56	45	60
Iowa . . .	48	60	14	60	70		56		32			56	45	60
Kansas . . .	48	60	14	60	70		56		32			56	45	60
Kentucky . . .	47	60	14	60	70		56		32	60		56	45	60
Louisiana . . .	32		14				56		32			32		60
Maine . . .	48	62					56		32	60				60
Maryland . . .									26					
Massachusetts . . .	48	60		60			56		32	60		56	45	60
Michigan . . .	48	60	14	60	70		56		32	60	14	56	45	60
Minnesota . . .	48	60	14	60	70		56		32	60	14	56	45	60
Mississippi . . .	48	60	14	60	72		56		32	60		56	45	60
Missouri . . .	48	60	14	60	70		56		32	60	14	56	45	60
Montana . . .	48	60	14	60	70		56		32	60		56	45	60
Nebraska . . .	48	60	14	60	70		56		32	60		56	45	60
New Hampshire . . .		62					56		32	60		56		60
New Jersey . . .	48	62		64			56		30	60		56		60
New York . . .	48	60		60			56		32	60		56	45	60
North Carolina . . .	48			60			56		32	60		56		60
North Dakota . . .	48	60		60	70		56		32	60		56	42	60
Ohio . . .	48	60		60	68		56		32	60		56	45	60
Oklahoma . . .	48	60		60	70		56		32	60		56	42	60
Oregon . . .	46			60			56		32			56		60
Pennsylvania . . .	47			60			56		32			56		60
Rhode Island . . .	48	60		60	70		56		32	60		56	45	60
South Carolina . . .														
South Dakota . . .	48	60		60	70		56		32	60		56	42	60
Tennessee . . .	48	60	14	60	70	74	56	20	32	60	14	56	45	60
Texas . . .	48	60		60	70	72	56		32			56	45	60
Vermont . . .	48	62		60			56		32	60		56	45	60
Virginia . . .	48	60	14	60	70		56		30		12	56		60
Washington . . .	48			60			56		32			56		60

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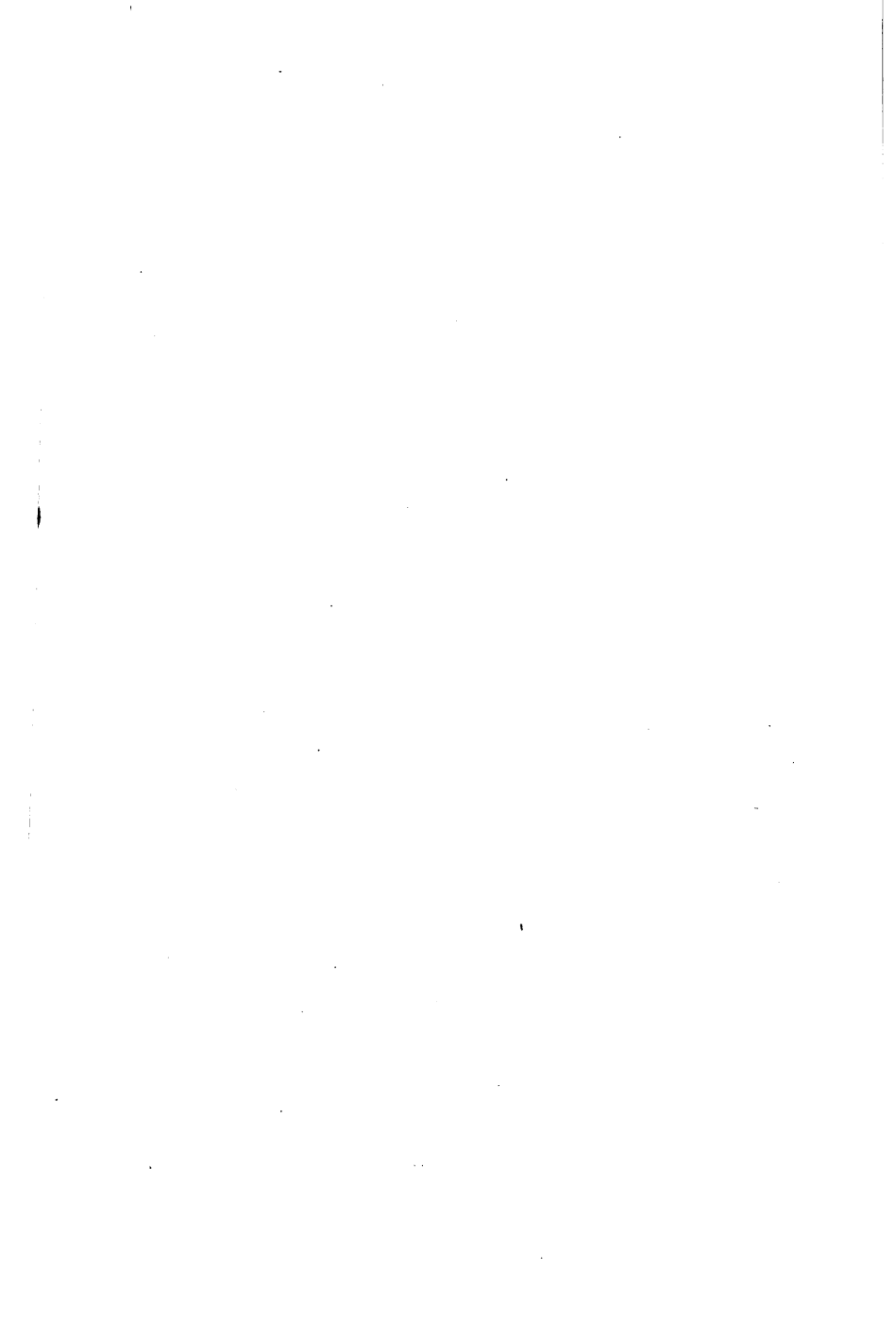
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